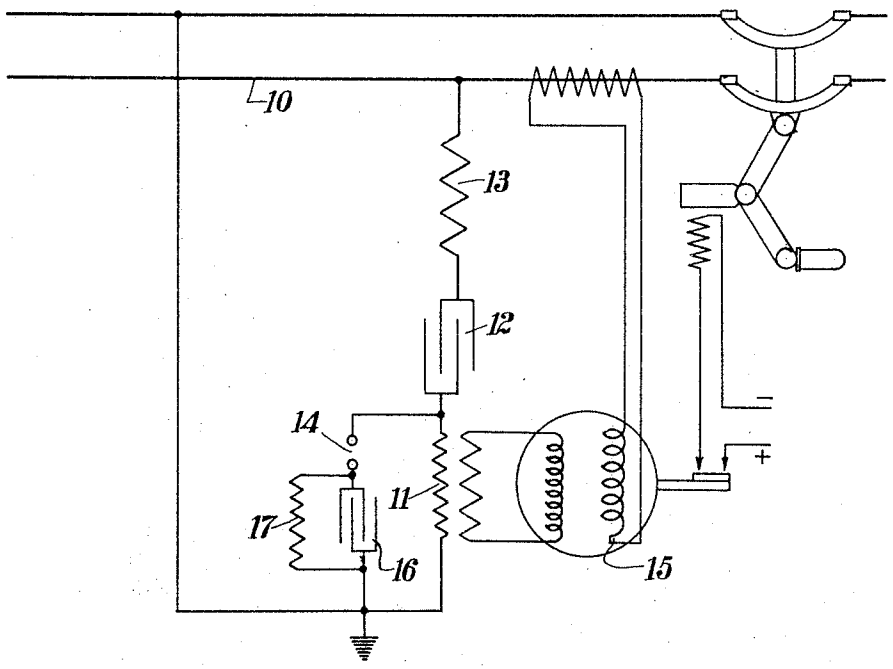
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CAPACITANCE COUPLING CIRCUITS

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CAPACITANCE COUPLING CIRCUITS

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This invention relates to capacitance couplings for high voltage transmission lines, and has for one of its objects the provision of improved means for protecting apparatus, thus connected, from high frequency or steep wave front surges.

A further object is to provide an arrangement which will protect an electrical translating device from high voltage surges but which will, during such surges, permit a limited voltage to be impressed upon the translating device.

A further object is to provide a capacitance connection for high voltage transmission lines which shall be of improved construction and operation.

Other objects and advantages will appear from the following description.

The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawing and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawing the figure is a circuit diagram illustrating one embodiment of the present invention.

At the present time, it is common practice to connect translating devices, requiring a relative small amount of energy, to high voltage transmission lines by means of a condenser in series with a relatively low voltage transformer. One difficulty with this form of connection is that while the condener offers relatively high impedance at commercial frequencies, it offers very low impedance to high frequencies or steep wave fronts, such as those produced by lightning.

This difficulty may be partially overcome by connecting a resistance in series with the condenser and by connecting a limiting gap in parallel with the primary of the transformer. Such a resistance has comparatively small effect for normal operation since it is a relatively small proportion of the total impedance in the circuit for low frequencies; but since the impedance of the condenser is very slight for high frequency or steep wave front surges, such as those caused by lightning, the resistance becomes a major portion of the total impedance under these conditions and is of material benefit in reducing the voltage imposed upon the transformer by lightning. The arcing gap may be set for any voltage desired so that the total voltage to which the transformer primary is subjected may be limited to any desired amount. However, for some purposes, his arrangement still has certain objections. If the current from the transformer is used to supply the voltage for a combined voltage and current relay, the voltage across the transformer may fall off during discharge of the arcing gap to such an extent as to cause the relay to trip unnecessarily.

In the present invention, I overcome this difficulty by providing a condenser in the shunt circuit and in series with the arcing gap, which condenser preferably has a considerably higher capacity than the condenser in series with the transformer primary. The arrangement is illustrated in the accompanying diagram in which 10 designates a high voltage transmission line to which a relatively low voltage transformer primary 11 is connected through a condenser 12 and a resistance 13. With the present invention the resistance 13 may be omitted if desired.

If the condenser has a capacity of .0003 microfarad, its impedance at 60 cycles will be 8,840,000 ohms and if the voltage on the line 10 is 66 k.v., the voltage on the primary 11 will be approximately 15 k.v. If the resistance 13 is 10,000 ohms, this will have little effect upon the current flowing in the circuit at normal frequency since 10,000 is but a small fraction of the impedance of the condenser at this frequency. If, however, the circuit is subjected to a lightning surge having a one-quarter microsecond wave front equivalent to a frequency of 1,000,000 cycles per second, the impedance of the condenser drops to 530 ohms so that under this condition the resistance 13 becomes the major portion of the impedance in the circuit and very materially reduces the voltage impressed upon the transformer winding.

To limit this voltage to a predetermined amount, an arcing gap 14 is connected in parallel with the transformer winding 11. If

the arcing gap be used alone, the voltage across the winding 11 may be reduced below normal voltage when a discharge occurs across the gap 14. Under some conditions this is objectionable as, for instance, when the transformer supplies voltage to a combined voltage and current relay indicated at 15 in the diagram. This objection may be overcome by connecting a supplemental condenser 16 in series with the gap 14; the supplemental condenser having a capacity several times that of the condenser 12. This capacity may be in the neighborhood of twenty times that of the condenser 12. Such a condenser may be readily made of mica and may be conveniently located under the oil in the same tank which contains the transformer.

This condenser provides sufficient impedance in the shunt circuit to prevent objectionable drop in the voltage impressed on the winding 11 when the gap 14 discharges. However, since the impedance of the condenser 12 will be approximately twenty times that of the condenser 16, the major portion of the surge voltage will be impressed upon the condenser 12 so that the winding 11 will not be subjected to destructive voltage. I prefer to connect a resistance 17 of several thousand ohms in shunt with the condenser 16 which will tend to suppress local oscillations resulting from the discharge of the gap 14 and will also serve to discharge the condenser 16 when the gap 14 has ceased to arc.

I claim:

1. Means for connecting a translating device to a high potential transmission line and for maintaining a voltage between predetermined limits on said translating device, said means comprising a condenser interposed in series between said transmission line and said translating device for reducing the voltage impressed, at normal frequencies, on said translating device by said transmission line, an arcing gap in shunt with said translating device to limit the voltage impressed on said translating device due to abnormal surges in said transmission line and to which surges said condenser offers less impedance than to normal currents, and an impedance in series with said arcing gap and in shunt with said translating device for maintaining the voltage on said translating device above a predetermined minimum value when said arcing gap discharges.

2. Means for connecting a translating device to a high potential transmission line and for maintaining a voltage on said translating device between predetermined limits, said means comprising a condenser connected in series between said transmission line and said translating device to reduce the voltage impressed upon said translating device at normal frequencies, and a shunt circuit in parallel with said translating device, said shunt circuit comprising an arcing gap for limiting the maximum value of the voltage on said translating device for high frequency surges to which said condenser offers reduced impedance, and a second condenser in series, in said shunt circuit, with said arcing gap for preventing reduction of the voltage on said translating device below a predetermined minimum value when said arcing gap discharges, said second condenser having a capacity several times that of said first named condenser so that when said condensers are connected in series by discharge through said arcing gap the voltage drop will be greater over said first named condenser than over said second named condenser.

3. The combination with a high potential transmission line, of a relay for controlling said line having a current winding and a potential winding and a circuit connecting said relay with said line and providing said potential winding with voltage between predetermined limits notwithstanding surges on said line, said circuit comprising a condenser connected in series between said potential winding and said transmission line and a shunt in series with said condenser and in parallel with said potential winding, said shunt having an arcing gap therein for limiting the maximum voltage impressed on said potential winding by a high frequency surge in said line to which surge said condenser offers less impedance than to currents of normal frequency, and a second condenser in said shunt in series with said arcing gap for preventing the voltage in said potential winding from falling below a predetermined minimum limit when said arcing gap discharges, said second named condenser having several times the capacity of said first named condenser to control the distribution of voltage between said condensers when said arcing gap discharges.

4. The combination with a high potential transmission line, of a relay for controlling said line having a current winding and a potential winding, and means for providing said potential winding with voltage between predetermined limits notwithstanding surges on said line, said means comprising a transformer having its secondary winding connected to the potential coil of said relay, a condenser connected in series between the primary of said transformer and said transmission line, and a shunt circuit in parallel with said primary, said shunt circuit comprising an arcing gap for limiting the maximum voltage impressed on said primary by a high frequency surge to which said condenser offers decreased impedance, a second condenser in said shunt circuit in series with said arcing gap for preventing the voltage on said primary from falling below a predetermined minimum limit when said arcing gap discharges, said second named condenser

having several times the capacity of said first named condenser to control the distribution of voltage between said condensers when said arcing gap discharges, and a high resistance shunt in parallel with said second named condenser.

In testimony whereof I have signed my name to this specification this 17th day of December, A. D. 1931.

WILLIAM A. HILLEBRAND.